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ABSTRACT

An inspecting apparatus for a semiconductor device comprises a match plate; a contact module combined with the match plate, and including a radiation unit contacting with the semiconductor device, and a test unit to press leads of the semiconductor device; and a thermal conductive pad installed on a contacting face of the radiation unit of the contact module, to transfer heat from the semiconductor device to the radiation unit of the contact module. With this configuration, the present invention provides an inspecting apparatus for semiconductor device that can improve reliability on a test of heat-durability of a semiconductor device and minimize an impact on the semiconductor device during a performance of the test.



DECLARATION

I, KIM, You-chul translator working at the Leaders Bldg. 3F. 1599-11 Seocho-dong, Seocho-gu Seoul 137-070 Republic of Korea and do hereby declare that I am familiar with the English language as a Korean and that the attached is a true English translation of the Korean transcript of Korean Patent Application Nos. 2003-40770 filed with the Korean Intellectual Property Office on June 23, 2003.

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DISCLOSURE

TITLE OF THE INVENTION

INSPECTING APPARATUS FOR SEMICONDUCTOR DEVICE

BRIEF DESCRIPTION OF THE DRAWINGS

The above and/or other aspects and advantages of the present invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompany drawings of which:

FIG. 1 is a perspective view of an inspecting apparatus for a semiconductor device according to the present invention;

FIG. 2 is a perspective view of a contact module of the inspecting apparatus for the semiconductor device according to the present invention;

FIG. 3 is a cross-sectional view of a combining structure of a match plate and the contact module of the inspecting apparatus for the semiconductor device according to the present invention;

FIG. 4 is a cross-sectional view of a combining structure of a thermal conductive pad of the inspecting apparatus for the semiconductor device according to the present invention;

FIG. 5A, 5B, and 5C are operation views of the inspecting apparatus for the semiconductor device according to the present invention.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an inspecting apparatus for a semiconductor device, more particularly to an inspecting apparatus for a semiconductor device that can minimize a defective rate of the semiconductor device caused by a faulty temperature condition during a test of heat-durability of the semiconductor device.

Description of the Related Art

Generally, a handler device comprises a handler distinguishing a defective semiconductor device, and a chamber unit testing heat-durability of a semiconductor device. Particularly, a condition of the chamber unit plays an important role in improving reliability on the test of the heat-durability of the semiconductor device.

A core technology of the chamber unit is a heating/cooling technology that keeps a constant temperature during a performance of the test, regardless of the heat radiated from the semiconductor device. Herein, the heating/cooling technology is divided into a direct cooling method spraying air to the semiconductor device,

and an indirect cooling method installing a radiation fin on the semiconductor device and spraying the air to the radiation fin. The indirect cooling method is mainly employed due to its relative better efficiency.

Most conventional inspecting apparatuses for a semiconductor device according to the indirect cooling method are configured to allow a heat sink to directly contact the semiconductor device to radiate the heat from the semiconductor device, or to use an additional heat transfer means to transfer the heat from the semiconductor device to the heat sink during the performance of the heat durability test.

Meanwhile, when the heat sink contacts the semiconductor device directly, contacting surfaces of the heat sink and the semiconductor device are hardly aligned in parallel due to an error in flatness of a match plate or ruggedness of the contacting surface of the semiconductor device. As a result, this structural problem prevents an efficient transfer of the heat from the semiconductor device to the heat sink.

Consequently, some of the heat leaked through an air layer between the contacting surfaces of the heat sink and the semiconductor device causes to increase the temperature of the chamber unit. Accordingly, the increase of the temperature of the chamber unit makes an error that the

inspecting apparatus for the semiconductor device recognizes a qualified semiconductor device as the defective semiconductor device, for example because the temperature of the semiconductor device is measured higher than the actual temperature of the semiconductor device by the leakage of the heat, thereby lowering the reliability on the heat-durability test of the semiconductor device. Additionally, a physical contact of the heat sink and the semiconductor device frequently damages the semiconductor device due to an inadvertency in use.

Recently, researches are proceeding on the inspecting apparatus for the semiconductor device configured to transfer the heat from the semiconductor device to the heat sink through the additional heat transfer means. Also a patent related to the art is already guaranteed under the Korean utility model registration No. 0171483. However, the inspecting apparatus for the semiconductor device described above not only requires a complex transfer structure including a radiation member, one of the heat transfer means, installed on a carrier module, but also is inefficient in transferring the heat because an area of the radiation member contacting the semiconductor device is relatively small.

As described above, the radiation member directly contacting the heat sink still has a problem of alignment

between the heat sink and the radiation member, and besides, it cannot improve a heat transferring efficiency and the defective rate of the semiconductor device down to a satisfactory degree.

ASPECT OF THE INVENTION

It is an aspect of the present invention to provide an inspecting apparatus for semiconductor device that can improve reliability on a test of heat-durability of a semiconductor device and can minimize an impact on the semiconductor device during a performance of the test.

CONSTITUTION OF THE INVENTION

The foregoing and other aspects of the present invention are achieved by providing an inspecting apparatus for a semiconductor device comprising a match plate; a contact module combined with the match plate, and including a radiation unit contacting with the semiconductor device, and a test unit to press leads of the semiconductor device; a thermal conductive pad installed on a contacting face of the radiation unit of the contact module, to transfer heat from the semiconductor device to the radiation unit of the contact module.

According to an aspect of the invention, the thermal conductive pad comprises a ceramic-silicon composite.

According to an aspect of the invention, the thermal conductive pad is installed on the radiation unit by a thermal conductive double-sided adhesive member.

According to an aspect of the invention, the thermal conductive double-sided adhesive member is made of acrylic polymer.

According to an aspect of the invention, the radiation unit of the contact module comprises a heat sink; a contact pusher contacted with the semiconductor device and installed with the thermal conductive pad on the contacting face; and a heat flat pusher combined with the contact pusher and the heat sink, to transfer the heat from the semiconductor device to the heat sink via the contact pusher.

According to an aspect of the invention, the heat sink is made of aluminum.

According to an aspect of the invention, the contact pusher and the heat flat pusher are made of aluminum.

According to an aspect of the invention, the test unit of the contact module comprises a contact block combined with the match plate, and formed with a heat sink seating part to accommodate the heat sink, and a through hole through which the heat flat pusher passes; and a lead pusher combined with a bottom of the contact block, to press the leads of the semiconductor device selectively

according to ascent and descent of the contact block by the match plate.

According to an aspect of the invention, the inspecting apparatus for semiconductor device further comprises a first elastic member installed on the circumference of the heat flat pusher to lift the contact block and the lead pusher up and down elastically.

According to an aspect of the invention, the inspecting apparatus for semiconductor device further comprises a second elastic member that is installed between the match plate and the contact block, to lift the contact block up and down elastically corresponding to the ascent and descent of the match plate, thereby allowing the lead pusher to press the leads of the semiconductor device.

According to an aspect of the invention, the first elastic member and the second elastic member are springs.

Hereinafter, reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

FIG. 1 is a perspective view of an inspecting apparatus for a semiconductor device according to the

present invention, FIG. 2 is a perspective view of a contact module of the inspecting apparatus for the semiconductor device according to the present invention, and FIG. 3 is a cross-sectional view of a combining structure of a match plate and the contact module of the inspecting apparatus for the semiconductor device according to the present invention.

As illustrated therein, an inspecting apparatus for a semiconductor device according to the present invention comprises a match plate 20, a contact module 50 combined with the match plate 20 and having a radiation unit 30 contacting a semiconductor device 70 and a test unit 40 pressing leads 72 of the semiconductor device 70, and a thermal conductive pad 60 installed on a contacting face of the radiation unit 30 of the contact module 50 to transfer heat from the semiconductor device 70 to the radiation unit 30 of the contact module 50.

The match plate 20 is formed with combining holes 22 capable of combining with a plurality of the contact module 50, and allows the test unit 40 of the contact module 50 to be selectively lifted up and down to test heat-durability of the semiconductor device 70. A structure of the match plate 20 may vary according to necessity.

The radiation unit 30 of the contact module 50 comprises a heat sink 32, a contact pusher 34 contacting

with the semiconductor device 70 and having the thermal conductive pad 60 installed on the contacting face of the contact pusher 34, and a heat flat pusher 36 combining with the contact pusher 34 and the heat sink 32 to transfer the heat from the semiconductor device 70 to the heat sink 32 via the contact pusher 34.

The heat sink 32 has a function of radiating the heat transferred from the semiconductor device 70 via the contact pusher 34 and the heat flat pusher 36 to the outside, and is formed with a plurality of groove strips 31 on the external surface of a cylindrical circumference to increase the area contacting air relatively. Also, the heat sink 32 may be made of various types of materials, but it is preferably made of aluminum or aluminum alloy which has a superior thermal conductivity and a competitive price. Alternatively, the heat sink 32 may have various structures which can improve the radiating efficiency thereof.

The contact pusher 34, which contacts the semiconductor device 70 directly, is installed with the thermal conductive pad 60 to efficiently transfer the heat from the semiconductor device 70 to the heat sink 32 without any leakage of the heat during a performance of the test by maximizing a contacting area and minimizing an impact at a moment of a physical contact with the semiconductor device 70. A configuration and a function of

the thermal conductive pad 60 will be described later in reference to FIG. 4.

The heat flat pusher 36 is formed with male screw taps on opposite ends. Also, the heat sink 32 and the contact pusher 34 are formed with respective female taps corresponding to the male screw tap to be combined with the male screw taps of the heat flat pusher 36. The heat flat pusher 36 and its combining structure may vary according to necessity.

The contact pusher 34 and the heat flat pusher 32 are preferably made of the aluminum or the aluminum alloy, which has the superior thermal conductivity and the competitive price, just as the heat sink 32 is made.

The test unit 40 of the contact module 50 is combined with the match plate 20 and comprises a contact block 42 formed with a heat sink seating part 41 where the heat sink 32 is seated and with a through hole 43 through which the heat flat pusher 36 passes, and a lead pusher 44 that is installed on the bottom of the contact block 42 and presses the leads 72 of the semiconductor device 70 selectively according to ascent and descent of the contact block 42 initiated by the match plate 20.

The contact block 42 is formed with an air inflow hole and an air outflow hole, through which the air flows in and out, respectively.

The lead pusher 44 presses the leads 72 of the semiconductor device 70 to get the semiconductor device 70 electrically connected to a test circuit (not shown), thereby performing the test of the heat-durability on the temperature of the semiconductor device 70.

A first elastic member 80 is installed on the circumference of the heat flat pusher 36 of the radiation unit 30, and a second elastic member 90 is installed between the match plate 20 and the contact block 42. Herein, as the match plate 20 lifts up and down, the contact block 42, which is elastically combined with the match plate 20, presses the contact pusher 34 to the semiconductor device 70 and the lead pusher 44 to the lead 72 of the semiconductor device 70.

The first elastic member 80 functions to elastically move to completely press the contact pusher 34 to the semiconductor device 70 according to the ascent and descent of the contact block 42.

The match plate 20 and the contact block 42 are elastically combined by the first elastic member 80.

The first elastic member 80 and the second elastic member 90 may be made of one of various elastic materials. However, a spring should be preferably chosen as the elastic member because of a simple structure and superior elasticity of the spring.

Meanwhile, the heat from the semiconductor device 70 is transferred to the heat sink 32 via the thermal conductive pad 60, the contact pusher 34, and the heat flat pusher 36.

FIG. 4 is a cross-sectional view of the combining structure of the thermal conductive pad 60 installed on the radiation unit 30 of the contact module 50 of the inspecting apparatus for the semiconductor device according to the present invention.

As illustrated therein, the thermal conductive pad 60 is preferably made of ceramic-silicon composite or material including the ceramic-silicon composite which has relatively high thermal conductivity, flexibility, compressibility, thermal resistance, and electric resistance, or may be made of one of various materials selectively according to necessity. Also, the thermal conductive pad 60 should be thick enough to be compressed by 1 ~ 2 mm deep.

The thermal conductive pad 60 is installed on the contact pusher 34 by a thermal conductive double-sided adhesive tape 62 to contact the semiconductor device 70, wherein the thermal conductive double-sided adhesive tape is preferably made of acrylic polymer or material including the acrylic polymer which has high thermal resistance to keep firm bonding force and thermal conductivity. The

thickness of the thermal conductive double-sided adhesive tape 62 should be less than 0.2mm to decrease the thermal resistance relatively.

Actually, in an experiment to detect a temperature variation in the chamber unit of the inspecting apparatus for the semiconductor device installed with the thermal conductive pad 60, there was a little increase in the temperature of the chamber unit. However, the amount of the increase was so insignificant that it is concluded that the inspecting apparatus for the semiconductor device could radically minimize the increase in the temperature of the chamber unit caused by the heat from the semiconductor device 70 as compared with the conventional inspecting apparatus.

FIG. 5A, 5B, and 5C are operation views of the inspecting apparatus for the semiconductor device according to the present invention.

First, the semiconductor device 70 is inserted into the chamber unit and is positioned corresponding to the bottom of the contact pusher 34 of the inspecting apparatus for the semiconductor device (refer to FIG. 5A).

The contact pusher 34 contacts the semiconductor device 70 by operation of the match plate 20. Herein, any excessive power of the contact pusher 34, at the moment the contact pusher 34 contacts the semiconductor device 70, may

be absorbed by the thermal conductive pad 60 installed on the contact pusher 34 (refer to FIG. 5b).

Lastly, after the thermal conductive pad 60 of the contact pusher 34 contacted the semiconductor device 70, the match plate 20 descends enough to press the lead pusher 44 against the lead 72 of the semiconductor device 70. Accordingly, the contact block 42 moves according to the operation of the match plate so that the lead pusher 44 electrically contacts the test circuit (not shown) and executes the test. After the execution of the test, the operation process described above is executed in reversed order. Additionally, when the match plate 20 descends, the second elastic member 90 is compressed, to thereby press the lead 72 of the semiconductor device 70. At the same time, the first elastic member 80 is also compressed to constantly press the contact pusher 34, to thereby allow the thermal conductive pad 60 installed on the contact pusher 34 to press the semiconductor device 70 completely (refer to FIG. 5c).

Consequently, an air layer between the contacting faces of the contact pusher 34 and the semiconductor device 70 can be completely removed, thereby minimizing the temperature variation of the chamber unit caused by the leakage of the heat radiated from the semiconductor device 70 during the test.

As described above, the inspecting apparatus for the semiconductor device according to the present invention can not only minimize the defective rate of the semiconductor device but also improve the reliability on the heat-durability test of the semiconductor device by using the thermal conductive pad, to thereby efficiently prevent an impairment of the semiconductor device during the test.

Hence, the inspecting apparatus for the semiconductor device can lower expenses for a faulty test result and an external impairment.

Although a few embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. An inspecting apparatus for a semiconductor device comprising:

a match plate;

a contact module combined with the match plate, and including a radiation unit contacting with the semiconductor device, and a test unit to press leads of the semiconductor device; and

a thermal conductive pad installed on a contacting face of the radiation unit of the contact module, to transfer heat from the semiconductor device to the radiation unit of the contact module.

2. The inspecting apparatus for the semiconductor device according to claim 1, wherein

the thermal conductive pad comprises a ceramic-silicon composite.

3. The inspecting apparatus for the semiconductor device according to claim 1 or 2, wherein

the thermal conductive pad is installed on the radiation unit by a thermal conductive double-sided adhesive member.

4. The inspecting apparatus for the semiconductor device according to claim 3, wherein

the thermal conductive double-sided adhesive member is made of acrylic polymer.

5. The inspecting apparatus for the semiconductor device according to claim 1, wherein

the radiation unit of the contact module comprises:

a heat sink;

a contact pusher contacted with the semiconductor device and installed with the thermal conductive pad on the contacting face; and

a heat flat pusher combined with the contact pusher and the heat sink, to transfer the heat from the semiconductor device to the heat sink via the contact pusher.

6. The inspecting apparatus for the semiconductor device according to claim 5, wherein

the heat sink is made of aluminum.

7. The inspecting apparatus for the semiconductor device according to claim 5, wherein

the contact pusher and the heat flat pusher are made of aluminum.

8. The inspecting apparatus for the semiconductor device according to claim 5, wherein

the test unit of the contact module comprises:

a contact block combined with the match plate, and formed with a heat sink seating part to accommodate the heat sink, and a through hole through which the heat flat pusher passes; and

a lead pusher combined with a bottom of the contact block, to press the leads of the semiconductor device selectively according to ascent and descent of the contact block by the match plate.

9. The inspecting apparatus for the semiconductor device according to claim 8, further comprising a first elastic member installed on the circumference of the heat flat pusher to lift the contact block and the lead pusher up and down elastically.

10. The inspecting apparatus for the semiconductor device according to claim 8 or 9, further comprising a second elastic member installed between the match plate and the contact block, to lift the contact block up and down elastically corresponding to ascent and descent of the match plate, thereby allowing the lead pusher to press the leads of the semiconductor device.

11. The inspecting apparatus for the semiconductor device according to claim 9 or 10, wherein the first and second elastic members are springs.